

filled with iron-nickel-sulphide and komatiite⁹. Similar contamination by melting wall rock during ascent of magmas through the crust is equally likely.

Until criteria to choose between mantle heterogeneity contamination or complete resetting of the Pb isotopes are found, or an independent age constraint is available on Kambalda, the uncertainty in the interpretation of the Sm-Nd age will remain. Resolution of the problem may have

important implications either for the degree of heterogeneity and depletion of the Archaean mantle or the extent of contamination of komatiite lavas. The latter may necessitate reinterpretation of the constraints komatiite lavas place on the chemistry of the Archaean mantle. □

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Ecology

Why be an evergreen?

from Peter D. Moore

CONSIDERING their importance to plants, it is surprising that we do not know more about leaves. What, for example, determines leaf size and what is the adaptive significance of size and longevity in leaves? Presumably the evolution of the evergreen habit conveys certain advantages upon a plant under given environmental conditions. What they may be is the question raised by three new studies¹⁻³.

It has long been recognized that there is a relationship between leaf form and climate⁴ but the causes underlying the relationship have proved elusive. Parkhurst and Loucks⁵ constructed a model of optimal leaf size on the assumption that the optimum under given conditions is that which provides the maximum efficiency of water use, that is the maximum uptake of CO₂ per unit of water lost. Thus, large leaves should be favoured only under warm conditions with low light intensity. They tested their model, which accounted for seven independent variables, and found it to match well with observed data. It has subsequently been shown to operate in a variety of situations including the Galapagos Islands, where there is a positive relationship between the average leaf size of a plant community and rainfall, and where leaves in the herbaceous layer of a structured community are larger when the canopy layer is denser⁶.

Although leaf size has been shown to follow certain rules, at least on a large scale consideration, leaf longevity has proved less amenable to explanation. Hamann found it difficult to explain the distribution pattern of evergreen species on the Galapagos Islands; no advantages over their deciduous counterparts were immediately apparent, though evergreens appear to be more frequent in sites with more prolonged drought⁶.

Explanations of the advantages of the evergreen habit have tended to fall into two camps. The main advantage is claimed to be energetic, the evergreen leaf being capable of taking advantage of short periods of suitable conditions within a generally unfavourable period of, for example, cold or drought. The alternative explanation proposes that long-lived

evergreen leaves act as storage systems for nutrients in short supply, such as nitrogen, phosphorus and potassium⁷, and that it is therefore of selective advantage to be an evergreen in low nutrient environments such as bogs and heathland.

In their recent review of the energetic advantages of evergreens in winter conditions, Larcher and Bauer⁸ comment on the scarcity of data. In general they feel that winter photosynthesis may be significant in Mediterranean and oceanic areas but it unlikely to be of importance in regions with severe winters. Robertson and Woolhouse¹ have now shown that a herbaceous species, the cotton sedge *Eriophorum vaginatum*, a major dominant species on the upland areas of northern and central Europe, retains some leaves through the winter which are capable of activity very early in the growing season. These leaves can be operating at up to half-maximal rates before the new season's crop of leaves has been produced, and they continue to photosynthesize throughout the growing season. Interestingly, however, the leaves of *E. vaginatum* also act as reservoirs for elements such as phosphorus and potassium⁹, so a combination of advantages could be involved here.

These observations apply to oceanic

environments but some comparable data have emerged from a distinctly continental environment in Utah in the United States. Nowak and Caldwell² monitored the photosynthetic rates of two introduced grasses, *Agropyron desertorum* and *A. spicatum*, during winter when the soil is permanently frozen and snow cover is intermittent. Many leaves of these grasses survive the winter and show a positive carbon gain during those periods when they are not covered with snow. Such observations provide fuel for the energetic advantages of evergreen leaves.

At the other end of the climate spectrum are the forests of north-east India. Shukla and Ramakrishnan find that the majority of early successional trees are of evergreen habit, but that the leaves are generally short-lived (usually less than 200 days) whereas late successional species, have a deciduous habit and their leaves may last 300 days. In that case, evergreen habit could be of advantage in providing fast growth, especially when combined with a rapid leaf turnover, enabling new leaves to be produced in the most appropriate positions to take advantage of the light.

The impression gained from these varied studies in a range of climatic regimes is that there is no simple, general reason why the evergreen habit can be of selective advantage. Both nutrient conservation and energetic opportunism may give a plant the necessary competitive edge when facing an unfavourable period. It clearly pays some plants to keep their leaves. □

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PRONUNCIATION OF CHINESE NAMES

SOMEWHAT after date, I beg to return to the subject of Anglo- and Franco-Chinese orthography, referred to in *NATURE* vol. xxx. p. 592. In a short paper of mine published in the *Proceedings of the Royal Geographical Society*, vol. xxii, No. 6, 1877, I alluded to the desirability of a uniform or fixed "Roman equivalent" for Chinese characters standing for names of place, &c. To my mind the Italian vowels, &c. come nearest to the sounds of the Chinese characters. *Tung-King*, meaning "Eastern Capital," is the usually accepted form of *Tonquin*, or *Ton-Kin*, the terminal *g* being

but slightly sounded. *Shang-hai*, the "Upper Sea," or the place "of going up to the sea," should be pronounced with the *g*, and is so spoken (Shanghai) by English and American authorities. Dr. Wells Williams has, I believe, in manuscript a standard Chinese Gazetteer of the world, in which all proper names likely to be used in telegraphy, newspapers, &c., are smoothly transliterated into Chinese characters. For translation from Chinese it is very necessary to adopt some such plan as Dr. Hunter has suggested for Indian names. Although his plan has come too late into the field to induce people to spell Calcutta as Kolkata, this is hardly the case as yet with Chinese names. The old native names of places should always be literally preserved. How much more beautiful is the old Franco-Indian name *Stadaconda* than *Quebec* for the scene of death of Wolfe! I should be glad to cooperate or correspond with any interested in this matter, so prominent and important at the present juncture.

From *Nature* **31**, 173, 25 December 1884.